



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/757,392	01/15/2004	You-seop Lee	249/438	4957
27849	7590	05/07/2008	EXAMINER	
LEE & MORSE, P.C.			WEINSTEIN, LEONARD J	
3141 FAIRVIEW PARK DRIVE				
SUITE 500			ART UNIT	PAPER NUMBER
FALLS CHURCH, VA 22042			3746	
			MAIL DATE	DELIVERY MODE
			05/07/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/757,392	LEE ET AL.	
	Examiner	Art Unit	
	LEONARD J. WEINSTEIN	3746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 03 March 2008.
- 2a) This action is **FINAL**. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1,3-9 and 11-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1,3-9 and 11-20 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ . |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ . | 6) <input type="checkbox"/> Other: _____ . |

DETAILED ACTION

1. This office action is in response to the amendment of March 3, 2008. In making the below rejections and/or objections the examiner has considered and addressed each of the applicant's arguments.
2. The examiner acknowledges the amendments to claim 1, 3, 4, and 9. The examiner notes that claims 2 and 10 have been cancelled by the applicant.
3. The examiner also notes that the request filed October 17, 2007 was mischaracterized as an improper request for continued prosecution in the prior office action of December 7, 2007. The request filed on October 17, 2007 was a proper request for continued examination and the following paragraph was omitted from the prior office action:

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 17, 2007 has been entered.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 4, 6-8, 17 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by the printed publication of TSAI et al., "A Thermal Bubble Actuated Micro Nozzle-Diffuser Pump", The 14.sup.th IEEE International Conference on Micro Electro Mechanical Systems, Interlaken, Switzerland, Jan. 21-25, 2001. With reference to the titles of the individual elements shown in

the schematic of figure 2, Tsai teaches all the limitations as claimed for a micro-pump including:

[claim 1] a pumping chamber (Pumping Chamber) to be filled with a fluid, at least one fluid entrance (Liquid Outlet) and at least one fluid exit (Liquid Inlet), each one of the fluid entrance (Liquid Outlet) and fluid exit (Liquid Inlet) being connected directly between the pumping chamber (Pumping Chamber) and a respective manifold (not shown), a heating element (Aluminum Heater) at one side of the pumping chamber (Pumping Chamber) to generate bubbles in the pumping chamber (Pumping chamber) by heating the fluid, and electrodes (second sentence in the first paragraph under "Conclusions") for applying current to the heating element (Aluminum Heater), wherein a fluid flow into or out of the pumping chamber (Pumping Chamber) is by expansion and contraction of the bubbles, and wherein a cross-sectional area of each of the fluid entrance (Liquid Outlet) and the fluid exit (Liquid Inlet) varies along a direction of the fluid flow to have a constant inclination angle along its entire length (figure 1), respectively, and wherein the cross-sectional area of the fluid entrance (Liquid Inlet) decreases (via the Diffuser Valve) in a direction toward the pumping chamber (Pumping Chamber), and the cross-sectional area of the fluid exit (Liquid Inlet) increases (via the Nozzle Valve) in a direction toward the pumping chamber (Pumping Chamber); **[claim 6]** a fluid entrance (Liquid Outlet) is provided at one side of the pumping chamber (Pumping Chamber) and the fluid exit (Liquid Inlet) is provided at an opposite side of the pumping chamber (Pumping Chamber) to face the fluid entrance (Liquid Outlet); **[claim 7]** each of the fluid entrance (Liquid Outlet) and the fluid exit (Liquid Inlet) has a pyramid shape (see figure 1); **[claim 8]** each of the fluid entrance (Liquid Outlet) and the fluid exit (Liquid Inlet) has a uniform height and a width varying in the direction of the fluid flow (see figure 1); **[claim 17]** a heating element (Aluminum Heater) is outside the pumping chamber (Pumping Chamber); **[claim 20]** and a

central axis along a length of each one of the fluid entrance (Liquid Outlet) and fluid exit (Liquid Inlet) is parallel to a bottom surface of the pumping chamber (Pumping).

The publication of Tsai further teaches the following limitations for a micro-pump including (again with reference to the reference titles in figure 2) : **[claim 4]** a pumping chamber (Pumping Chamber) to be filled with a fluid, at least one fluid entrance (Liquid Inlet) and at least one fluid exit (Liquid Outlet), each one of the fluid entrance (Liquid Inlet) and fluid exit (Liquid Outlet) being connected directly between the pumping chamber (Pumping Chamber) and a respective manifold (not shown), a heating element (Aluminum Heater) at one side of the pumping chamber (Pumping Chamber) to generate bubbles in the pumping chamber (Pumping Chamber) by heating the fluid (see "Abstract"), and electrodes (see second sentence in the first paragraph under section "Conclusions") for applying current to the heating element (Aluminum Heater), wherein a fluid flow into or out of the pumping chamber (Pumping Chamber) is by expansion and contraction of the bubbles (see "Abstract"), and wherein a cross-sectional area of each of the fluid entrance (Liquid Inlet) and the fluid exit (Liquid Outlet) varies along a direction of the fluid flow to have a constant inclination angle along its entire length, respectively, wherein the cross-sectional area of the fluid entrance (Liquid Inlet) increases in a direction toward the pumping chamber (Pumping Chamber), and the cross-sectional area of the fluid exit (Liquid Outlet) decreases in a direction toward the pumping chamber (Pumping Chamber) and wherein each of the pumping chamber (Pumping Chamber – as shown in figure 2)) and the heating element (Aluminum Heater – as shown in figure 3 (b) and characterized "meander-shaped" in the second paragraph under the section "Device Structure and Fabrication") has a circular shape.

The examiner notes that the device disclosed in the Tsai publication has been interpreted two different ways and applied to each of the independent claims 1 and 4. The examiner has interpreted the Liquid Inlet and Liquid Outlet to each function as an entrance and an exit. Each component inherently accomplishes both functions at different times during operation. The interpretations presented by the examiner find support in the disclosure of Ma US 6,655,924 in column 1, lines 43-56, which states that backflow occurs in both an inlet and outlet of a micro-pump such as the one disclosed in the cited publication.

6. Claims 1, 6-9, 11-16, and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Baughman et al. US 5,387,314. Baughman teaches all the limitations as claimed for a micro-pump including: **[claim 1]** a pumping chamber 15 to be filled with a fluid, at least one fluid entrance 14b and at least one fluid exit 20, each one of the fluid entrance 14b and fluid exit 20 being connected directly between the pumping chamber 15, as shown in figure 1, and a respective manifold 13, a heating element 16 (col. 4 ll. 1-4) at one side of the pumping chamber 15 to generate bubbles in the pumping chamber 15 by heating the fluid, and electrodes (col. 5 ll. 65-67) for applying current to the heating element 16, wherein a fluid flow into or out of the pumping chamber 15 is by expansion and contraction of the bubbles, and wherein a cross-sectional area of each of the fluid entrance 14b and the fluid exit 20 varies along a direction of the fluid flow to have a constant inclination angle along its entire length, respectively, and wherein the cross-sectional area of the fluid entrance 14b decreases in a direction toward the pumping chamber 15, and the cross-sectional area of the fluid exit 20 increases in a direction toward the pumping chamber 15; **[claim 6]** a fluid entrance 14b is provided at one side (bottom) of the pumping chamber 15 and the fluid exit 20 is provided at an opposite side (top) of the pumping chamber 15 to face the fluid entrance 14b; **[claim 7]** a

fluid entrance 14b and the fluid exit 20 has a pyramid shape, as shown in figures 1 and 2a;

[claim 8] a fluid entrance 14b and the fluid exit 20 has a uniform height and a width varying in the direction of the fluid flow, as defined by the direction of flow through each of elements 14b and 20 respectively; **[claim 9]** a micropump 10 including the pumping chamber 15 and the heating element 16 formed in a hexahedral shape, element 16 is formed in the shape of a cuboid and element 15 where at least of portion of which between element 24 and the section where element 14 begins is in the shape of a modified quadrilateral frustum; **[claim 11]** a heating element 16 is formed of a resistive heating material (a resistor as disclosed); **[claim 12]** a substrate 12 surrounding portions of the pumping chamber 15, the fluid entrance 14b, and the fluid exit 20; **[claim 13]** an insulation layer 26 between the substrate 12 and the heating element 16, the insulation layer 26 being in communication with the fluid in the pumping chamber 15; **[claim 14]** a passivation layer 26 (as element 26 is disclosed as both a "passivating layer" and a "in-sulating dielectric layer" - col. 6 ll. 38-48) on the heating element 16 and the electrodes (col. 5 ll. 64-67); **[claim 15]** a heat dissipation layer 17 formed on the passivation layer 26 for dissipating heat, wherein the heat dissipation layer 17 is connected to the substrate 12, as shown in figure 6D; **[claim 16]** a heat dissipation layer 17 is formed of a metal; **[claim 18]** and one of the fluid entrance 14b and the fluid exit 20 includes a surface slanted at an angle with respect to a bottom surface of the pumping chamber 15 (element 20).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 3 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over the printed publication of TSAI et al., "A Thermal Bubble Actuated Micro Nozzle-Diffuser Pump", The 14.sup.th IEEE International Conference on Micro Electro Mechanical Systems, Interlaken, Switzerland, Jan. 21-25, 2001.

With respect to claim 3, Tsai discloses the general conditions of the claimed invention except for the express disclosure of a fluid entrance and a fluid exit formed to have an inclination angle of about 50° to about 70°. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a fluid entrance and a fluid exit for a micro-pump, formed to have an inclination angle of about 50° to about 70°, since the claimed values are merely an optimum or workable range.

With respect to claim 5, Tsai discloses the general conditions of the claimed invention except for the express disclosure of a fluid entrance and a fluid exit formed to have an inclination angle of about 30° or less. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a fluid entrance and a fluid exit for a micro-pump, formed to have an inclination angle of about 30° or less, since the claimed values are merely an optimum or workable range.

It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

10. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baughman US 5,387,314. Baughman discloses the general conditions of the claimed invention except for the express disclosure of a fluid entrance and a fluid exit formed to have an inclination angle of about 50° to about 70°. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a fluid entrance and a fluid exit for a micro-pump, formed to have an inclination angle of about 50° to about 70°, since the claimed values are merely an optimum or workable range. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

11. Claim 16 rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Baughman et al. US 5,387,314, as applied to claim 15 above, and further evidenced by Takahashi et al. US 6,428,875. Baughman teaches all the limitations as claimed including a layer of photopolymerizable material (col. 3 ll. 59-61) that is etched/developed to form a pattern opening with element 17. As evidenced by Takahashi, metallocene is a known photopolymerizable material used in printer technology to form pattern layers of material (Takahashi – col. 8 ll. 25-67; col. 9 ll. 1-12). Further, it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Art Unit: 3746

12. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baughman US 5,387,314. Baughman teaches the claimed invention except for providing a heating element outside of a pumping chamber. It would have been obvious to one having ordinary skill in the art at the time the invention was provide a heating element outside of pump chamber in order to eject droplets of ink through a nozzle (Baughman – col. 3 ll. 66-col. 4 ll. 4). It has been held that rearranging parts of an invention involves only routine skill in the art. In re Japikse, 86 USPQ 70.

13. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baughman as applied to claim 13 above. Baughman teaches the claimed invention except for providing an insulation layer on an upper wall of a pump. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide an insulation layer on an upper wall of a pump in order to provide an insulating dielectric layer in a micro-pump (Baughman - col. 6 ll. 38-48). It has been held that rearranging parts of an invention involves only routine skill in the art. In re Japikse, 86 USPQ 70.

Response to Arguments

14. Applicant's arguments filed March 3, 2008 have been fully considered but they are not persuasive. The examiner notes applicant's arguments with respect to the rejection of claims 1, 4, 6-9, 18, and 20 under 35 U.S.C. 102(e) as anticipated by Ma US 2003/0086790. In particular the examiner notes applicant's statement that the limitations of claim 2, now incorporated into independent claim, distinguishes over the prior art disclosed by Ma in figures 1A and 1B. The prior art disclosed by Ma was the printed publication of TSAI et al., "A Thermal Bubble Actuated Micro Nozzle-Diffuser Pump", The 14.sup.th IEEE International Conference on Micro Electro Mechanical Systems, Interlaken, Switzerland, Jan. 21-25, 2001. The Tsai publication and the

Art Unit: 3746

disclosure of Ma (¶ 0009) clearly set forth a teaching of a liquid inlet and a liquid outlet that each function, and can be considered, as both a fluid entrance and fluid exit. It is also noted by the examiner that is interpretation is similar to applicant's depiction of fluid flow in embodiments shown in figures 5A and 5B of the instant application. The disclosure designates elements 113 and 114 as a fluid inlet and a fluid outlet respectively. Fluid that flows from a supply that is connected to an inlet manifold 115 enters a pump chamber through inlet element 113, however as disclosed in ¶0055-0056 of the instant invention both elements 113 and 114 function as inlets and outlets for a pump chamber. This portion of the disclosures provides a written description which supports the limitations claimed in both independent claims 1 and 4 as well as supporting the examiner's interpretation of the instant references. The examiner has interpreted the Liquid Inlet and Liquid Outlet disclosed in the Tsai publication in the same manner in which the applicant has characterized the claimed invention in the disclosure of the instant application.

The examiner also notes that claim 4 has been amended into independent form and incorporated the limitations of now canceled claim 10. The Tsai publication provides more structural details regarding the heating element that clearly show an element arranged in a circular shape with figure 3(b). The entire heating element is arranged by following a path including sinuous curved sections or loops. The path starts at a central axis of a circular section formed on the surface of a layer of glass and goes back and forth between a central axis and an outer circumference of the circular section. Therefore the entire arrangement of the heating element path forms a circular shaped heater disposed over a pumping chamber and anticipates the limitations as claimed.

Art Unit: 3746

15. Applicant's arguments with respect to claims 1, 3-9, and 11-20 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LEONARD J. WEINSTEIN whose telephone number is (571)272-9961. The examiner can normally be reached on Monday - Thursday 7:00 - 5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Devon Kramer can be reached on (571) 272-7118. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 3746

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Devon C Kramer/
Supervisory Patent Examiner, Art Unit
3683

/Leonard J Weinstein/
Examiner, Art Unit 3746